REMARKS

Claims 38-45 were pending in this application when the present Final Office Action was mailed (June 3, 2005). In this paper, no claims have been amended or added. Accordingly, claims 38-45 are presently pending in the application.

In the June 3, 2005 Final Office Action, all the pending claims were rejected. More specifically, the status of the application in light of the Final Office Action is as follows:

(A) Claims 38-41 and 45 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,249,053 to Nakata et al. ("Nakata") in view of computer translation of Japanese Document No. JP 10-98045 to Shoji ("Shoji");

(B) Claim 42 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata in view of Shoji and further in view of U.S. Patent No. 5,834,848 to Iwasaki ("Iwasaki");

(C) Claim 43 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata in view of Shoji, further in view of Iwasaki, and further in view of U.S. Patent No. 6,285,083 to Imai et al. ("Imai"); and

(D) Claim 44 stands rejected under 35 U.S.C. 103 (a) as being unpatentable over Nakata in views of Shoji and further in view of Imai.

A. Response to Section 103 Rejection – Nakata and Shoji

Claims 38-41 and 45 were rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata in view of Shoji ("Shoji"). For the reasons discussed below, the rejection is improper because the proposed combination of the Nakata and Shoji references does not teach all the claim limitations of claim 38. Accordingly, the Section 103 rejection of claims 38-41 and 45 should be withdrawn.

Claim 38 is directed to a packaged microelectronic device. The device includes a microelectronic die having an integrated circuit and a plurality of bond-pads coupled to

the integrated circuit. The device also includes an interposer substrate having a first side coupled to the die, a second side opposite the first side, a plurality of ball-pads arranged on the second side to be coupled to a printed circuit board, interconnects electrically coupled to the bond-pads on the die and the ball-pads, and a solder-mask on the second side having openings over the ball-pads. In addition, a plurality of solder balls are arranged so that each solder-ball is in an opening of the solder-mask and contacting a corresponding ball pad. Furthermore, a dielectric compound is in the openings of the solder-mask and surrounds a portion of the perimeter of each of the ball-pads and the solder-balls. Accordingly, a packaged microelectronic device having features of claim 38 prevents electrical shorts between a solder ball and exposed portions of adjacent trace lines in the solder mask openings.

Nakada discloses forming a chip package that improves the adhesive strength of solder balls to ball-pads without forming leads for plating (Abstract). The adhesive strength is improved by electroplating a Ni/Au layer in a desired interconnect pattern onto copper foils attached to the resin substrate (Nakata at column 8, lines 20-28). The copper foils then function conveniently as leads for plating (Nakata at column 8, lines 18-20). A solder mask is formed on the portion of the interconnect pattern except ball pads formed by the Ni/Au layer (Nakata at column 9, lines 49-53, Figure 13).

Shoji discloses a method of forming reinforced solder bumps (Abstract). A solder bump 14 is attached to the pad 13c by melting and solidifying a spherical solder ball (Shoji at paragraph 0020). A solder resist layer 13b formed on the front face of the interposer joins "the solder bump 14 to pad 13c" (Shoji at paragraph 0020). A masking resin film 16 is deposited on top of the solder bump 14 (Shoji at paragraph 0024). A second resin film 15, which does not have "an affinity mutually" with film 16, is deposited on interposer layer 13b to reinforce the solder bump 14 by forming a supporting layer around the base of the solder bump 14 (Shoji at paragraph 0027, Figure 3(a)-(c)).

Claim 38 is patentable over the combination of Nakata and Shoji because these references fail to teach all the limitations of claim 38. For the sake of argument,

assuming the second resin film 15 of Shoji corresponds at least in part to the dielectric compound of claim 38, Shoji fails to teach or suggest having a dielectric compound in the openings of the solder mask such that the dielectric compound surrounds at least a portion of the perimeter of each of the ball pads and the solder balls. Instead, Shoji teaches improving the stability of the solder bump 14 by (a) surrounding the solder ball with a solder resist 13b, (b) forming the solder bump 14 by melting and solidifying the solder ball to fill the opening of the solder resist 13b, and (c) depositing a second resin film 15 on top of solder resist 13b to surround the solder bump 14. Clearly, Shoji does not teach having any openings in the solder resist 13b over the solder bump 14, and the second resin film 15 cannot surround pad 13c because the melted solder ball would completed fill up any openings. Contrarily, leaving such openings would reduce the stability of the solder bump 14 due to the reduced contact areas with the pad 13c in direct opposition to the teachings of Shoji. As a result, Shoji fails to teach or suggest having a dielectric compound in the openings of the solder mask 13b and surrounding at least a portion of the perimeter of the ball pads with the dielectric compound. Nor does Nakata teach such features of claim 38. Thus, the proposed combination of Nakata and Shoji as set forth in the pending Final Office Action would result in a device in which the mother board side of the substrate in Nakata (as shown in Figure 13) includes solder bumps 14 whose bases completely fill up any openings in solder resist 13b and are surrounded by the second resin film 15 deposited on the solder resist 13b for improved stability (as shown in Figure 2 of Shoji). Accordingly, for at least the reasons discussed above, the combination of Nakata and Shoji fails to teach all the limitations of claim 38.

Claim 38 is accordingly patentable over the combination of Nakata and Shoji. Claim 39 is patentable over this combination of references as depending from allowable claim 38, and because claim 39 contain additional features.

Claim 40 contains subject matter similar to claim 38. In addition, claim 40 includes the additional features that a trace line is adjacent to the ball-pad, and that the dielectric compound in the openings of the solder mask electrically insulates the ball-

pad and the solder-ball from any exposed portion of the adjacent trace line in the opening. Neither Nakata nor Shoji teaches these additional features. In the present Final Office Action, the Examiner characterized the copper foil 6(3) in Nakata as the adjacent trace line. The applicant respectfully disagrees with this characterization. However, for the sake of argument, assuming the copper foil 6(3) corresponds at least in part to the adjacent trace line of claim 40, Nakata still fails to teach using a dielectric compound to electrically insulate the ball-pad and the solder-ball from any exposed portion of the adjacent trace lines. The pads 10b of Nakata is a layer of very conductive Ni/Au material 9 plated on the conductive copper foil 3. As a result, the pad 10c formed by the Ni/Au layer 9 is always in intimate electrical contact with the alleged adjacent trace line, i.e., the copper foil 6(3). Thus, irrespective of insulating material deposited on the pad 10b, the pad 10b may not be electrically insulated from the alleged adjacent trace line. Nor does Shoji teach such features of claim 40. Therefore, for at least the reasons discussed above, the combination of Nakata and Shoji references fails to teach the additional features of claim 40.

Accordingly, claim 40 is patentable over Nakata in view of Shoji because of the reasons discussed above with reference to claim 38 and the additional features of claim 40. Claims 41 and 45 are patentable over Nakata in view of Shoji because these claims depend from claim 40 and also because these claims include additional features. Accordingly, the Section 103 rejection of claims 38-41 and 45 should be withdrawn.

B. Response to Section 103 Rejection – Nakata, Shoji, and Iwasaki

Claim 42 was rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata in view of Shoji and further in view of Iwasaki. As discussed above, the combination of the Nakata and Shoji references fails to teach and suggest all the claim limitations of claim 40, and Iwasaki fails to fill this void. As a result, claim 42 is patentable over the combination of Nakata, Shoji, and Iwasaki because claim 42 depends from claim 40, and also because claim 42 includes additional features. Accordingly, the Section 103 rejection of claim 42 should be withdrawn.

C. Response to Section 103 Rejection – Nakata, Shoji, Iwasaki, and Imai

Claim 43 was rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata in view of Shoji, further in view of Iwasaki, and further in view of Imai. As discussed above, the combination of the Nakata, Shoji, and Iwasaki references fails to teach and suggest all the claim limitations of claim 40, and Imai fails to fill this void. As a result, claim 43 is patentable over the combination of Nakata, Shoji, Iwasaki, and Imai because claim 43 depends from claim 40, and also because claim 43 includes additional features. Accordingly, the Section 103 rejection of claim 43 should be withdrawn.

D. Response to Section 103 Rejection – Nakata, Shoji, and Imai

Claim 44 was rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata in view of Shoji and further in view of Imai. As discussed above, the combination of the Nakata and Shoji references fails to teach and suggest all the claim limitations of claim 40, and Imai fails to fill this void. As a result, claim 44 is patentable over the combination of Nakata, Shoji, and Imai because claim 44 depends from claim 40, and also because claim 44 includes additional features. Accordingly, the Section 103 rejection of claim 44 should be withdrawn.

E. Conclusion

In view of the foregoing, the pending claims patentably define over the applied art. The applicant respectfully requests reconsideration of the application and a mailing of a Notice of Allowance. If the Examiner has any questions or believes a telephone conference would expedite prosecution of this application, the Examiner is encouraged to call the undersigned representative at (206) 359-6038.

Respectfully submitted,

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